

Lake of the Woods Vegetation Management Plan Update

Marshall County, Indiana

2007-2011



http://129.79.145.7/arcims/statewide_mxd/viewer.htm

Prepared for:

The Lake of the Woods Property Owners Association

3119 Sea Lane
Bremen, IN 46506

Prepared by:

Aquatic Weed Control

P.O. box 325
Syracuse, IN 46567

Executive Summary

In late September of 2006 very small areas of EWM re-growth were observed in the north end of the lake. Based on these observations, as well as results from previous Sonar treatments, EWM was expected to return in somewhat greater abundance in 2007. Eurasian watermilfoil was found in approximately 18 acres of Lake of the Woods in 2007. These 18 acres of Lake of the Woods were treated with 2, 4-D for the control of Eurasian watermilfoil (EWM) in 2007. Major areas of re-growth were in the channel systems adjacent to Lake of the Woods and the far north end of the lake. Re-growth in these areas was expected in 2007, as Eurasian watermilfoil growth was very heavy in these areas prior to the whole lake Sonar treatment on May 5, 2005.

Two aquatic vegetation surveys were conducted on Lake of the Woods in 2007. A visual survey was conducted on June 13, 2007 to identify areas of EWM re-growth and develop a treatment map. Based on observations from this survey, approximately 18 acres of Lake of the Woods were treated for EWM on July 18, 2007. The second survey was a Tier II vegetation survey conducted on August 15, 2007. The August survey found that EWM was present in only 2 of the original 18 treatment acres. These 2 acres were then treated on August 24, 2007 to further reduce the EWM population.

Native plant populations increased in Lake of the Woods in 2007. Six native plant species were found in 2007, which is an increase from 4 native species in fall of 2006. Slender naiad, Illinois pondweed, and sago pondweed have all shown increases in site frequency since the whole lake sonar treatment.

Although it is not known how many acres may be affected by Eurasian watermilfoil re-growth in 2008, funding should be set aside to provide maintenance of the invasive plant. Areas of Eurasian watermilfoil re-growth will be treated with Renovate herbicide (active ingredient: triclopyr). Should permitting issues or EWM growth patterns delay treatment, 2, 4-D may be used in place of Renovate as was the case in 2007. 2,4-D achieves control more rapidly than Renovate, and may be the most effective management option in mid to late summer.

2008 Cost Estimates

***All cost figures are estimates only. All prices are subject to change pending 2008 chemical pricing.**

1. Chemically treat areas of Eurasian milfoil re-growth

A. Treat up to 30 acres for Eurasian milfoil with Renovate or 2, 4-D \$14,250

2. Conduct a spring visual survey for EWM and a late season Tier II vegetation survey

A. Aquatic Vegetation Surveys and Plan Update Up to \$4,000

Acknowledgements

Aquatic vegetation surveys conducted on Lake of the Woods were made possible by funding from the Lake of the Woods Property Owner's Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both Tier I and Tier II aquatic vegetation surveys. Gwen White and Angela Sturdevant, aquatic biologists for the IDNR Division of Fish and Wildlife provided valuable consultation regarding the requirements and objectives of this lake management plan. Brad Fink and Jason Doll provided assistance and training for data analysis computer programs. District 1 Fisheries Biologist Bob Robertson also provided valuable input for this project, and provided DNR survey data. Aquatic Weed Control would also like to thank the members of the Lake of the Woods Property Owner's Association for their commitment to improving Lake of the Woods and for valuable discussion and input brought forward at the informational meeting held on November 3, 2007.

Table of Contents

1.0 Introduction	6
2.0 Watershed and Lake Characteristics Update	8
3.0 Lake Uses Update	10
4.0 Fisheries Update	12
5.0 Problem Statement	12
6.0 Management Goals and Objectives	12
7.0 Plant Management History Update	13
8.0 Aquatic Plant Community Characterization Update	13
8.1 Methods Update	13
8.2 Results	15
8.2.1 Tier II Results	15
8.3 Macrophyte Inventory Discussion	20
9.0 Aquatic Vegetation Management Alternatives	21
10.0 Public Involvement	21
12.0 Integrated Management Action Strategy	24
13.0 Project Budget	24
14.0 Monitoring and Plan Update Procedures	25
15.0 References	25
16.0 Appendices	26
16.1 Calculations	26
16.2 Common Aquatic Plants of Indiana	29
16.3 Pesticide Use Restrictions Summary:	29
16.4 Resources for Aquatic Management	30
16.5 State Regulations for Aquatic Plant Management	31
16.6 Species Distribution Maps	33
16.7 Data Sheets	41
16.8 IDNR Aquatic Vegetation Control Permit	46

List of Figures

Figure 1: 2007 Eurasian Watermilfoil Treatment Areas.....	6
Figure 2: Lake of the Woods Dissolved Oxygen Profile.....	8
Figure 3: Lake of the Woods Temperature Profile	9
Figure 4: Lake of the Woods Ski Course.....	11
Figure 5: Lake of the Woods Eurasian Watermilfoil.....	12
Figure 6: Tier II Rake Sample Locations.....	15
Figure 7: Lake of the Woods Algal Bloom.....	20
Figure 8: August 2007 Sago Pondweed Locations	33
Figure 9: August 2007 Slender Naiad Locations.....	34
Figure 10: August 2007 Illinois Pondweed Locations.....	35
Figure 11: August 2007 Eurasian Watermilfoil Locations	36
Figure 12: August 2007 Elodea Locations.....	37
Figure 13: August 2007 Curly Leaf Pondweed Locations.....	38
Figure 14: August 2007 Coontail Locations	39
Figure 15: August 2007 Chara Locations	40

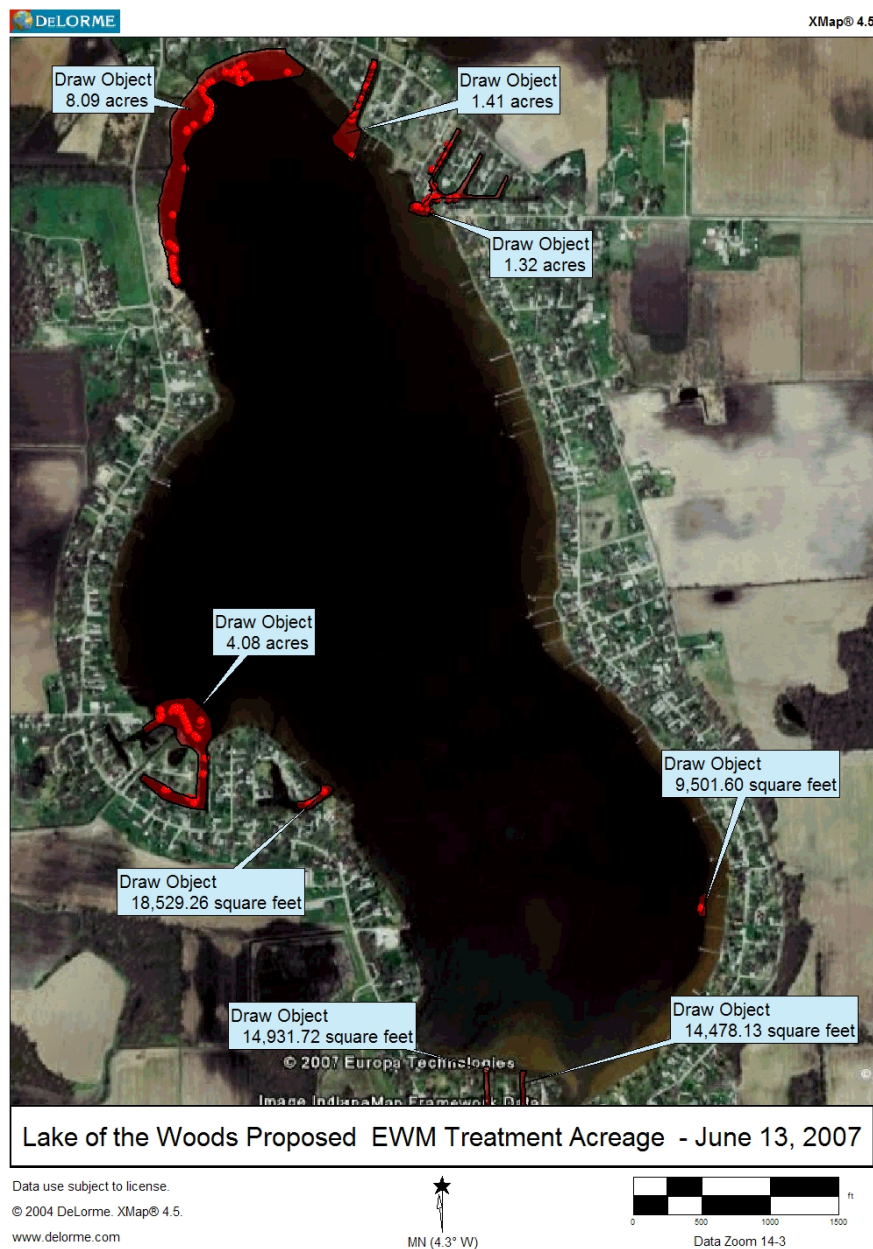
List of Tables

Table 1: Lake of the Woods LARE History	7
Table 2: August 2007 Data Analysis - 350 Foot Buffer Zone.....	11
Table 3: Sample Depth by Trophic State.....	14
Table 4: Sample Sites by Lake Size and Trophic State	14
Table 5: August 2007 Data Analysis - Overall.....	16
Table 6: August 2007 Data Analysis 0 - 5 Feet.....	17
Table 7: August 2007 Data Analysis 5 - 10 Feet.....	17
Table 8: 2007 Site Frequencies.....	18
Table 9: Lake of the Woods Site Frequency History.....	18
Table 10: Lake of the Woods Plant Dominance History	19
Table 11: Public Questionnaire.....	22
Table 12: Pesticide Use Restrictions.....	29

1.0 Introduction

Lake of the Woods has been involved in the Lake and River Enhancement Program (LARE) since 2004, when the first LARE funded aquatic vegetation survey took place on August 25, 2004. Based on the results of this survey, a whole lake Sonar treatment was conducted in the following spring on May 5, 2005 for the control of Eurasian watermilfoil (EWM). The treatment was successful, and EWM was not found in the fall survey that year or in either of the surveys in 2006. A visual survey on June 13, 2007 found EWM growing in approximately 18 acres of Lake of the Woods. These 18 acres were treated with 2, 4-D on July 18, 2007 for the control of EWM. Figure 1 shows the 2007 treatment areas in Lake of the Woods.

Figure 1: 2007 Eurasian Watermilfoil Treatment Areas



Based on observations and Tier II survey results, the treatments greatly reduced EWM abundance. Two acres of Lake of the Woods were treated on August 24, 2007 to further reduce the EWM population.

The following chart summarizes all LARE funded activities on Lake of the Woods.

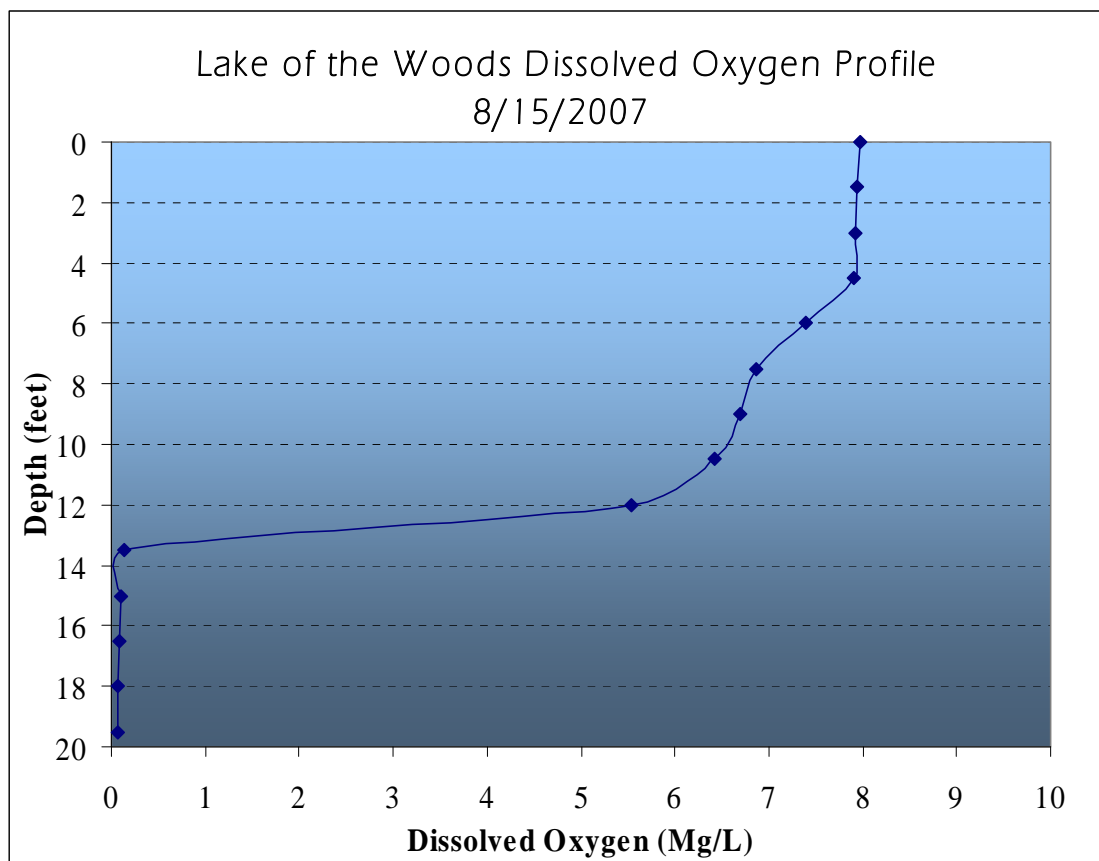
Table 1: Lake of the Woods LARE History

Year	Action	Date	Funding Source
2004	Fall Aquatic Vegetation Survey. Lake Management Plan	Fall Survey August 25, 2004	Lake and River Enhancement LOTW Property Owner's Association
2005	Spring and Fall Aquatic Vegetation Surveys as well as whole Lake Sonar Treatment Management Plan Update	Spring Survey April 28, 2005 Sonar Application May 5, 2005 Fall Survey July 29, 2005	Lake and River Enhancement LOTW Property Owner's Association
2006	No chemical treatments necessary as EWM did not return Management Plan Update	Spring Survey May 18, 2006 Fall Survey July 27, 2006	Lake and River Enhancement LOTW Property Owner's Association
2007	Spring Visual Vegetation Survey 18 acres of EWM treated with 2, 4-D Fall Tier II survey 2 acres of EWM treated with 2, 4-D	Spring survey June 13, 2007 Treatment July 18, 2007 Fall survey August 15, 2007 Treatment August 24, 2007	Lake and River Enhancement LOTW Property Owner's Association

2.0 Watershed and Lake Characteristics Update

Secchi depth was measured at 2.5 feet on August 15, 2007, indicating low water clarity. Planktonic algae blooms were common prior to the whole lake Sonar treatment and remain common, especially in late summer. Dissolved oxygen levels were measured by Aquatic Weed Control on August 15, 2007. Figure 2 shows dissolved oxygen data for Lake of the Woods.

Figure 2: Lake of the Woods Dissolved Oxygen Profile

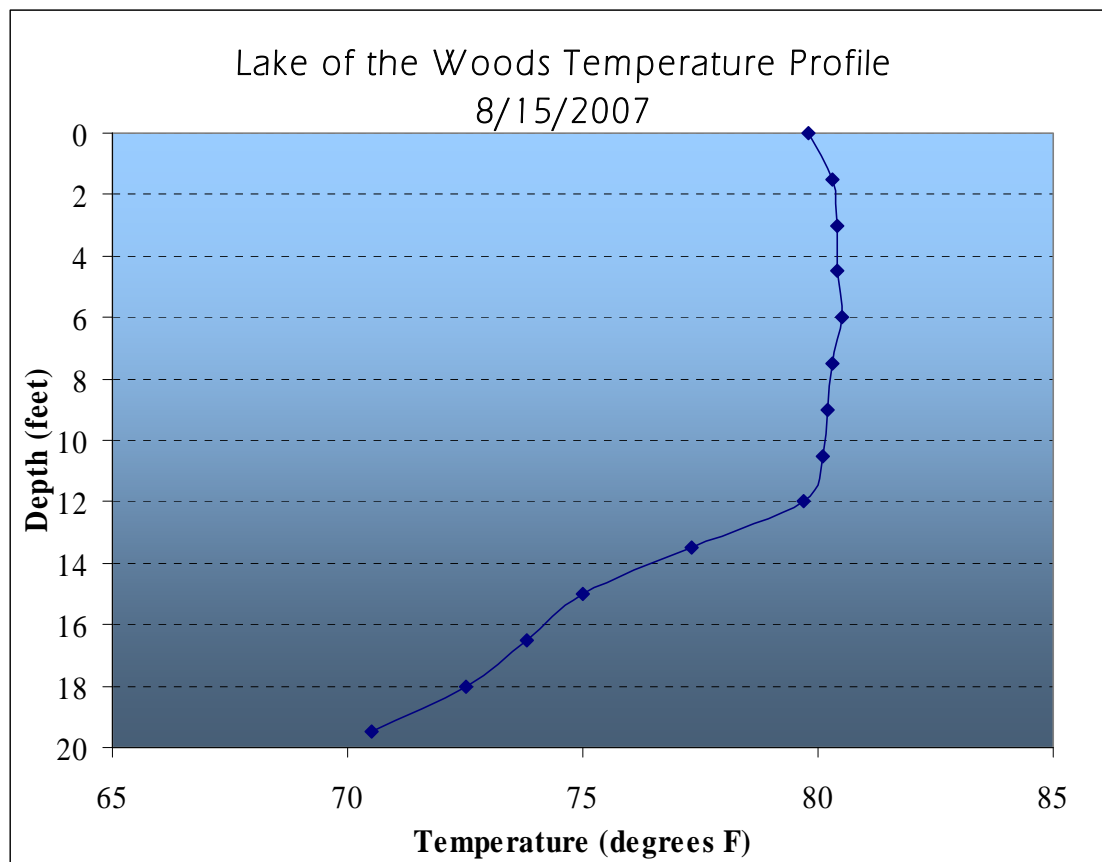


Dissolved oxygen requirements to maintain healthy fish populations of warm-water species are at least 2-5 mg of oxygen per liter of water, while cold-water fish species require 5-9 mg of oxygen per liter of water (Kalff, 2002, p237).

The metalimnion is the transition zone between the surface water and the deep water. It is usually accompanied by rapid changes in dissolved oxygen and temperature. The metalimnion in Lake of the Woods is between 10 and 24 feet, characterized by a rapid loss of dissolved oxygen. On August 15, 2007, Lake of the Woods had adequate oxygen to support fish life down to roughly 12 feet.

Figure 3 shows a temperature profile for Lake of the Woods.

Figure 3: Lake of the Woods Temperature Profile

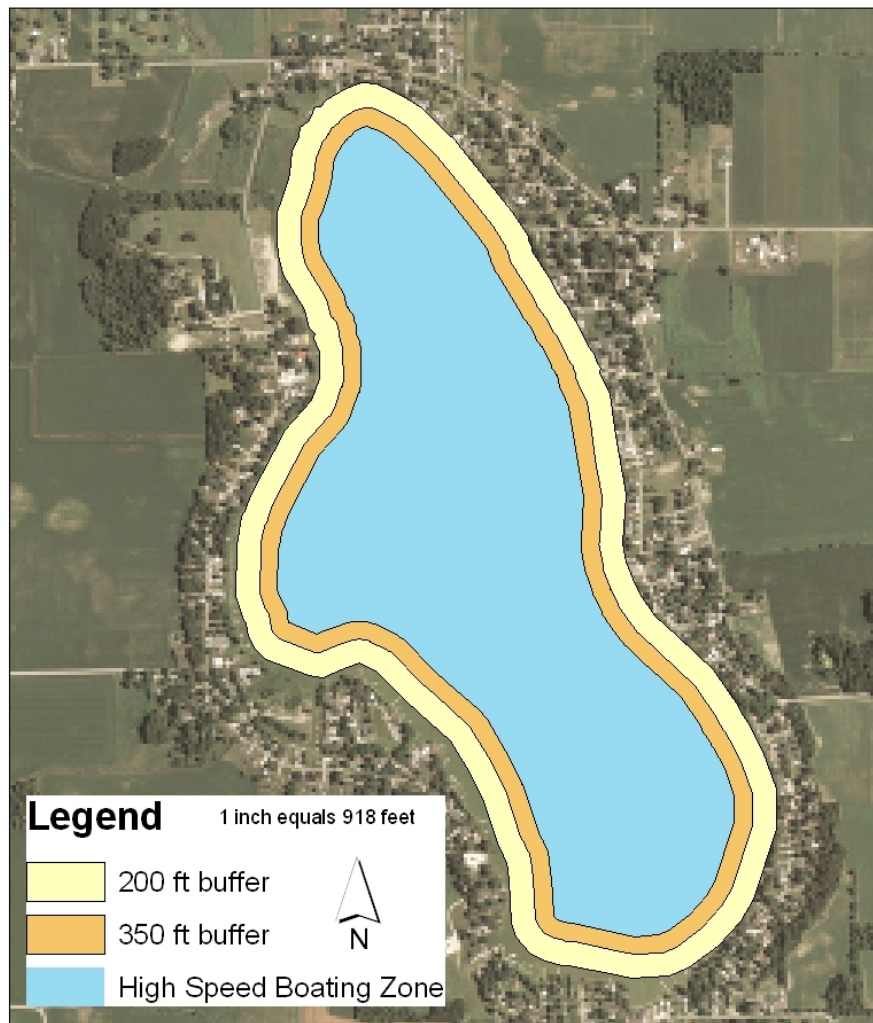


The thermocline is a rapid temperature change associated with the transition from surface water to deep water. In Lake of the Woods water temperature remains stable from the surface down to 12 feet. Temperature then drops rapidly with depth. This indicates a thermocline at around 12 feet.

3.0 Lake Uses Update

The idle zone in Lake of the Woods has been expanded to include the area within 350 feet of the shoreline. This change was implemented to allow for longer pier lengths in areas of the lake where shallow water makes boat access very difficult. The following map was provided by the IDNR and outlines the idle zone expansion area.

Lake of the Woods
Idle zone expansion



Data from rake samples taken inside the 350 buffer zone were analyzed separately. The data in the following table includes every rake sample taken within 350 feet of the shoreline. It is included in the Lake Uses section to avoid confusion with data analysis of the entire lake. This data can be compared with future surveys to track any effects that the expanded buffer zone may have on the plant community. Table 2 shows data from rake samples taken within the 350 foot buffer zone.

Table 2: August 2007 Data Analysis - 350 Foot Buffer Zone

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	LOTW Buffer	Secchi:	2.5	SE Mean Species/site:	0.13
Date:	8/15/07	Littoral sites with plants:	32	Mean natives/site:	0.78
Littoral depth (ft):	9.0	Number of species:	8	SE Mean natives/site:	0.12
Littoral sites:	55	Maximum species/site:	4.0	Species diversity:	0.73
Total sites:	60	Mean number species/site:	0.87	Native diversity:	0.67
Common Name	Site Frequency	1	Score Frequency	5	Dominance
Sago Pondweed	40.0	18.3	18.3	3.3	18.0
Illinois Pondweed	13.3	6.7	3.3	3.3	6.7
Slender Naiad	11.7	10.0	0.0	1.7	3.7
Coontail	8.3	3.3	5.0	0.0	3.7
Curly Leaf	5.0	5.0	0.0	0.0	1.0
Chara	3.3	3.3	0.0	0.0	0.7
Eurasian Watermilfoil	3.3	3.3	0.0	0.0	0.7
Elodea	1.7	1.7	0.0	0.0	0.3
Filamentous Algae	8.3				

Recreational use of Lake of the Woods was improved for boaters and skiers during 2005 and 2006. Dense beds of Eurasian watermilfoil that had previously interfered with these activities were no longer a problem. Figure 4 shows a ski course is located in the large bay on the west shore of the lake. This area was once heavily infested with EWM.

Figure 4: Lake of the Woods Ski Course

Weed lines composed of Eurasian Watermilfoil that were once used by fishermen were also removed with the whole lake treatment. According to discussions with District 1 Fisheries Biologist Bob Robertson, fisheries surveys found that walleyes, one of the main sportfish in the lake, were relating to the sago pondweed beds which are increasing in Lake of the Woods. Other beneficial native plants like Illinois pondweed are also increasing in the lake.

4.0 Fisheries Update

District 1 Fisheries Biologist Bob Robertson was contacted for the most recent fisheries survey data. He stated that a creel survey was conducted on Lake of the Woods in 2007, and ran through October. The report for this survey is not yet available, but will be included in a management plan update when completed. The most recent fisheries data can be found in the 2006 management plan update.

5.0 Problem Statement

Eurasian watermilfoil no longer dominates the plant community at Lake of the Woods. Its abundance is increasing however, and effective spot herbicide treatments will help to give native plants a competitive edge over EWM as they increase as well. Treatments using the herbicides Renovate or 2, 4-D may be used to reduce areas of EWM re-growth, and prevent native plants from being shaded out.

Figure 5 shows a milfoil bed in the north corner of Lake of the Woods prior to treatment in 2007.

Figure 5: Lake of the Woods Eurasian Watermilfoil



6.0 Management Goals and Objectives

The management goals outlined by the IDNR Division of Fish and Wildlife have not changed. They are restated below:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Specific Objectives

The major objective of this project has changed from a large scale treatment effort to reduce the dominant milfoil population, to smaller scale treatments in areas where re-growth is observed in 2008. Renovate or 2, 4-D may be used to treat these areas.

7.0 Plant Management History Update

District 1 Fisheries Biologist Bob Robertson was contacted to determine any significant changes to aquatic vegetation control permits. The only major changes to the plant management history have been the LARE funded herbicide treatments. The whole lake Sonar treatment was conducted on May 5, 2005. On July 18, 2007, 18 acres in Lake of the Woods were treated with 2, 4-D for the control of Eurasian watermilfoil. These areas can be seen in Figure 1. Private treatments have been discouraged, as native plants re-colonize the lake following the Sonar Treatment.

8.0 Aquatic Plant Community Characterization Update

One major change in protocol for 2007 is the absence of the Tier I reconnaissance survey. Survey intensity is now being tailored to individual lakes, depending on their own unique set of circumstances and management activities. Some lakes which may have been surveyed twice annually in the past may only be surveyed once each season. Surveys on some lakes that have been intensely surveyed in recent years may change to visual surveys as opposed to more time consuming quantitative vegetation surveys. These changes provide better quality of service and more efficient use of funding on Indiana lakes.

An updated Tier II survey protocol has been established by the IDNR. These changes are outlined in the methods section (8.1).

8.1 Methods Update

The Tier II survey protocol was updated by the IDNR in 2007. New LARE Tier II protocol requires that sample sites be stratified by depth contour, and that data analysis be provided for each depth contour. Rake scores for plant species are recorded as 1, 3, or 5, as opposed to the original scoring system of 1, 2, 3, 4, or 5.

The number of sample sites needed for a Tier II survey still is based on both lake size and trophic state, as it was in 2006. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: Oligotrophic, Mesotrophic, Eutrophic, and Hypereutrophic. Oligotrophic Lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 3 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear,

plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 3: Sample Depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 4 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 4: Sample Sites by Lake Size and Trophic State

Tier II Sampling 3

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

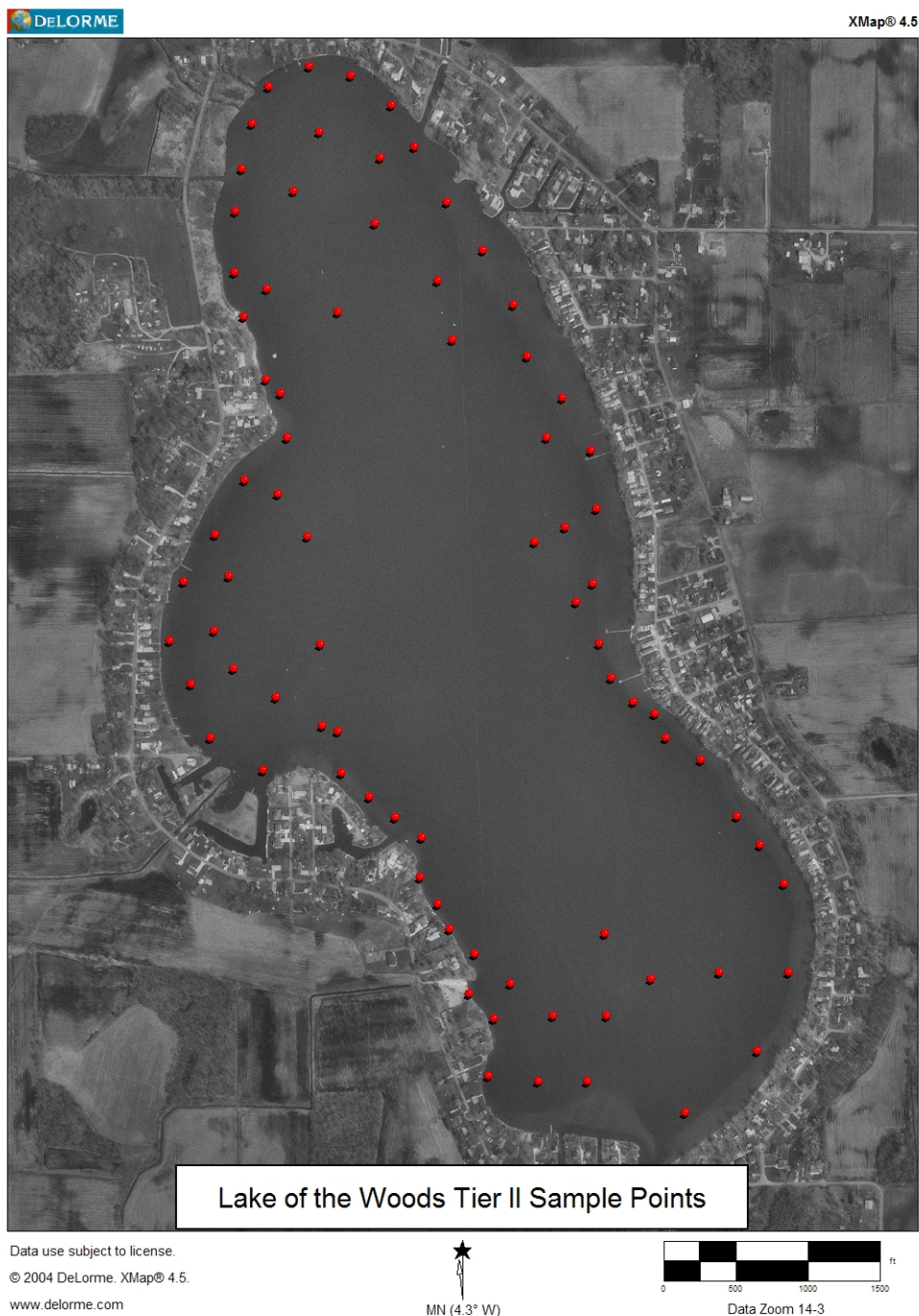
Lake Acres	Total # of Sites	Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
		0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

8.2 Results

8.2.1 Tier II Results

The 2007 Tier II vegetation survey took place on August 15, 2007. Secchi depth was measured at 2.5 feet. Eighty rake samples were distributed throughout the lake. Rake samples were divided between each 5 foot depth contour of the littoral zone. Sample sites remained the same from the fall 2006 survey. Figure 6 shows all 2007 rake sample locations.

Figure 6: Tier II Rake Sample Locations



Data Analysis

The following tables are data summaries for the 2007 Tier II aquatic vegetation survey. These tables help to describe the plant community, and will help identify any changes that take place in the years to come. Tables labeled "Overall" include every sample site, and while the others describe the 5 foot depth contours of the littoral zone.

Although samples sites were taken in depths reaching 15 feet of water, no plants were found in water more than nine feet deep. For this reason, there is no data analysis for the 10-15 foot depth contour.

Table 5: August 2007 Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	Lake of the Woods	Secchi:	2.5	SE Mean Species/site:	0.1
Date:	8/15/07	Littoral sites with plants:	0	Mean natives/site:	0.59
Littoral depth (ft):	9.0	Number of species:	8	SE Mean natives/site:	0.10
Littoral sites:	64	Maximum species/site:	4	Species diversity:	0.73
Total sites:	80	Mean number species/site:	0.65	Native diversity:	0.67
			Score Frequency		
Common Name	Site Frequency	1	3	5	Dominance
Sago Pondweed	30.0	13.8	13.8	2.5	13.5
Illinois Pondweed	10.0	5.0	2.5	2.5	5.0
Slender Naiad	8.8	7.5	0.0	1.3	2.8
Coontail	6.3	2.5	3.8	0.0	2.8
Curly-leaf Pondweed	3.8	3.8	0.0	0.0	0.8
Chara	2.5	2.5	0.0	0.0	0.5
Eurasian Watermilfoil	2.5	2.5	0.0	0.0	0.5
Elodea	1.3	1.3	0.0	0.0	0.3
Filamentous Algae	6.3				

Table 6: August 2007 Data Analysis 0 - 5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet					
Lake:	Lake of the Woods	Secchi:	2.5	SE Mean Species/site:	0.15
Date:	8/15/07	Littoral sites with plants:	29	Mean natives/site:	1.02
Littoral depth (ft):	9.0	Number of species:	8	SE Mean natives/site:	0.15
Littoral sites:	43	Maximum species/site:	4	Species diversity:	0.74
Total sites:	43	Mean number species/site:	1.14	Native diversity:	0.68
			Score Frequency		
Common Name	Site Frequency	1	3	5	Dominance
Sago Pondweed	51.2	23.3	23.3	4.7	23.3
Illinois Pondweed	18.6	9.3	4.7	4.7	9.3
Slender Naiad	16.3	14.0	0.0	2.3	5.1
Coontail	9.3	2.3	7.0	0.0	4.7
Curly-leaf Pondweed	7.0	7.0	0.0	0.0	1.4
Chara	4.7	4.7	0.0	0.0	0.9
Eurasian Watermilfoil	4.7	4.7	0.0	0.0	0.9
Elodea	2.3	2.3	0.0	0.0	0.5
Filamentous Algae	9.3				

Table 7: August 2007 Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	Lake of the Woods	Secchi:	2.5	SE Mean Species/site:	0.06
Date:	8/15/07	Littoral sites with plants:	3	Mean natives/site:	0.11
Littoral depth (ft):	9.0	Number of species:	2	SE Mean natives/site:	0.06
Littoral sites:	21	Maximum species/site:	1	Species diversity:	0.44
Total sites:	27	Mean number species/site:	0.11	Native diversity:	0.44
			Score Frequency		
Common Name	Site Frequency	1	3	5	Dominance
Sago Pondweed	7.4	3.7	3.7	0.0	3.0
Coontail	3.7	3.7	0.0	0.0	0.7
Filamentous Algae	0.0				

Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \left(\frac{\text{\# of sites where the species was collected}}{\text{Total \# of littoral sample sites}} \right) \times 100$$

Table 8 shows site frequencies from the 2007 Tier II survey of Lake of the Woods. Sago pondweed was the most frequently collected species followed by Illinois Pondweed. Eurasian watermilfoil had a site frequency of 2.5. Locations where Eurasian watermilfoil was found were treated after this survey.

Table 8: 2007 Site Frequencies

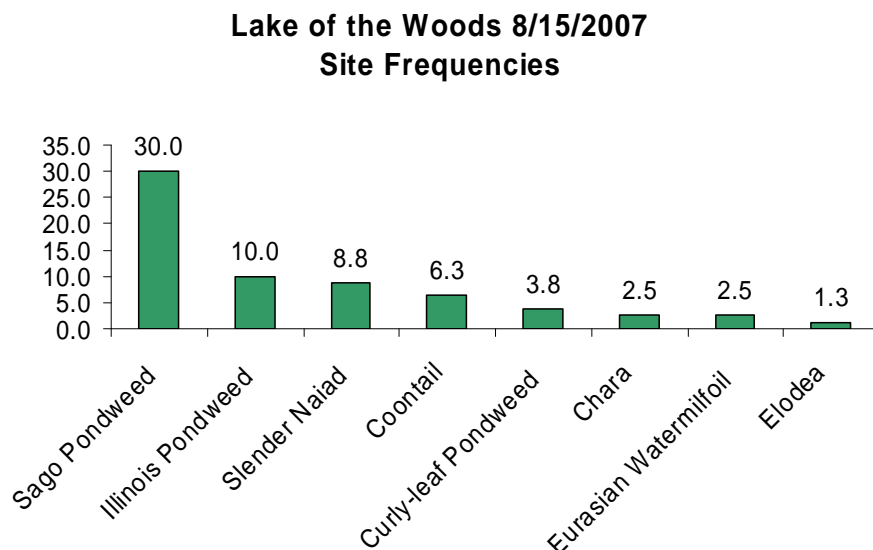
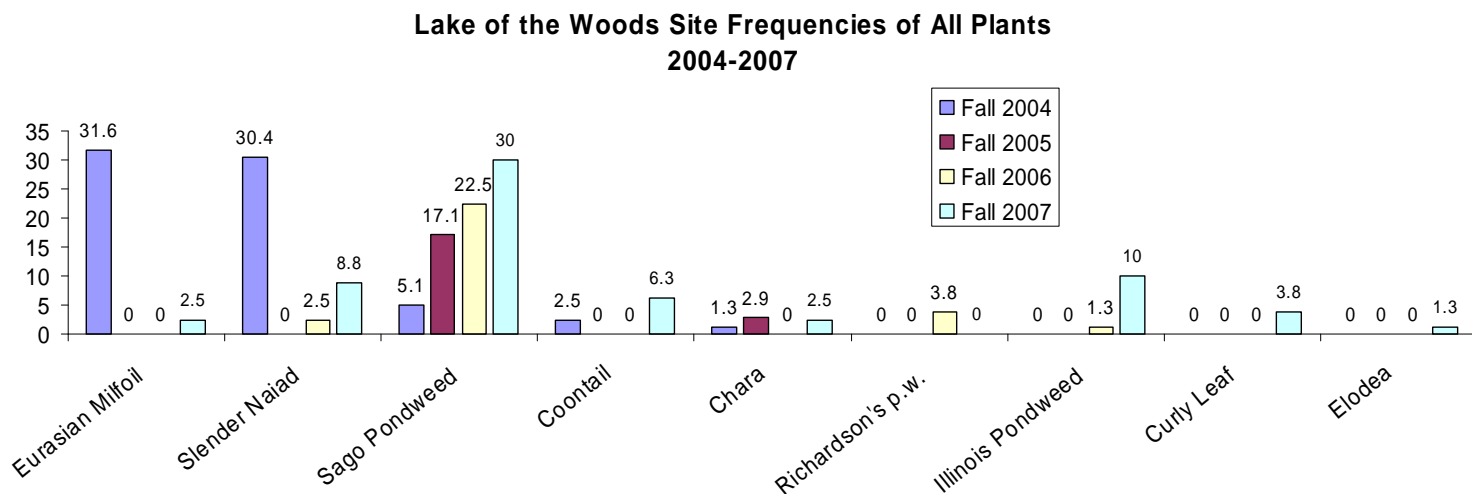


Table 9 shows site frequencies for every plant collected in any of the fall Tier II surveys since the lake was involved in the LARE program. Eurasian watermilfoil was the most frequently collected species in fall of 2004. The whole lake Sonar treatment took place in spring of 2005. Slender naiad was also very common in fall of 2004 and started to come back in fall of 2006. Sago pondweed abundance has steadily increased, probably as a result of reduced competition from Eurasian watermilfoil. Sago pondweed is also known to be resistant to fluridone, which may also account for its increasing abundance. Spot treatments in 2007 helped EWM frequency to remain low.

Table 9: Lake of the Woods Site Frequency History



Species Diversity

The species diversity indices listed in the data analysis tables help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

The species diversity index for Lake of the Woods in the fall of 2007 was 0.73, up from 0.41 in 2006. Native plant diversity in fall of 2007 was 0.67, also up from the 2006 native diversity of 0.41.

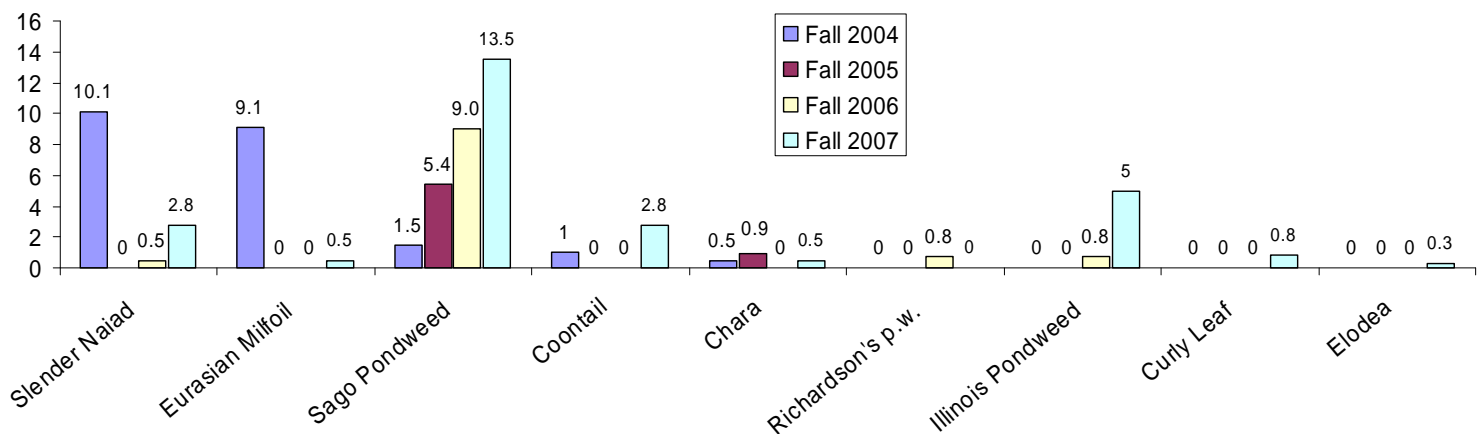
Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 10 tracks dominance values for each plant collected at Lake of the Woods during its involvement in the LARE program. Trends are similar to sight frequency, with Eurasian watermilfoil and slender naiad dominances dropping sharply after the Sonar treatment. Sago pondweed dominances have increased steadily since the whole lake Sonar treatment.

Table 10: Lake of the Woods Plant Dominance History

Lake of the Woods Dominance Values for All Plants 2004-2007



8.3 Macrophyte Inventory Discussion

Six native plants showed an increase in site frequency and dominance from fall 2006 to fall 2007. Sago pondweed has gradually increased in abundance ever since the whole lake Sonar treatment and now has a site frequency of 30 %. Slender naiad, which was common before the Sonar treatment is once again increasing in Lake of the Woods, with a site frequency of 8.8 % in fall of 2007. Illinois pondweed, a native plant which was not found in Lake of the Woods prior to the Sonar treatment, now has a site frequency of 10%.

Water clarity remains low, with a secchi depth of 2.5 feet being recorded on August 15, 2007. Algal blooms contribute to low water clarity, and will likely limit plant growth in depths of over 10 feet. Figure 7 shows planktonic algae that was concentrated at the IDNR public access site in August of 2007.

Figure 7: Lake of the Woods Algal Bloom



Eurasian watermilfoil has returned to the lake and its abundance is expected to increase as well. Site Frequency dropped from 31.6 % in 2004 before the Sonar treatment to 0% after the treatment in 2005. In fall of 2007 EWM site frequency was 2.5%. Spot treatments for the control of EWM helped keep its abundance low. Curly leaf pondweed is present as well, mainly in the far north end of the lake. Populations of both EWM and curly leaf pondweed should continue to be monitored.

9.0 Aquatic Vegetation Management Alternatives

(See 2004 Lake Management Plan)

Eurasian watermilfoil control practices have not changed significantly from the practices outlined in the original lake management plan.

10.0 Public Involvement

A LARE meeting was held on November 8, 2007 to discuss issues pertaining to Lake of the Woods. District 1 Fisheries staff, lake representatives, Aquatic Weed Control, and LARE Aquatic biologists were all present and discussed the plant community of Lake of the Woods. This meeting helped to develop the 2008 treatment strategy.

A public lake meeting was held for Lake of the Woods on November 3, 2007. Twenty people were in attendance. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined possible treatments that may be necessary as the Eurasian watermilfoil begins to re-grow in the lake. Residents were very happy with the results of the Sonar treatment, as Eurasian watermilfoil was reduced to an undetectable level in summers of 2005 and 2006. Table 11 shows a summary of responses from the public questionnaire handed out at the November 3rd meeting.

Table 11: Public Questionnaire

Lake Use Survey Total: 20 Lake name Lake of the WoodsAre you a lake property owner? Yes 20 No 0Are you currently a member of your lake association? Yes 19 No 0How many years have you been at the lake? 2 or less - 0
2 - 5 years - 5
5-10 years - 4
Over 10 years - 11

How do you use the lake (mark all that apply)

17 Swimming4 Irrigation20 Boating0 Drinking water18 Fishing3 Other view, peace, sunsets, wildlifeDo you have aquatic plants at your shoreline in nuisance quantities? Yes 10 No 9Do you currently participate in a weed control project on the lake? Yes 15 No 4Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 8 No 10Does the level of vegetation in the lake affect your property values? Yes 10 No 6Are you in favor of continuing efforts to control vegetation on the lake? Yes 20 No 0Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 18 No 1

Mark any of these you think are problems on your lake:

2 Too many boats access the lake7 Use of jet skis on the lake2 Too much fishing7 Fish population problem17 Dredging needed1 Overuse by nonresidents4 Too many aquatic plants0 Not enough aquatic plants16 Poor water quality6 Pier/funneling problem

Please add any comments:

I hope we can maintain the weed eradication program already in progress; muck problem on shore; 2-level lake water; a level lake causes many problems - eg the North End; many weeds in the north shore channel + the channel is getting shallower
I feel we need to be able to use the lake for the rec. sea
 Lowering the dam leaves us with muck 20 ft from our se
 loss of game fish when spillway is open - verified across road in rock pool Isaac Sells ditch.

11.0 Public Education

Hydrilla

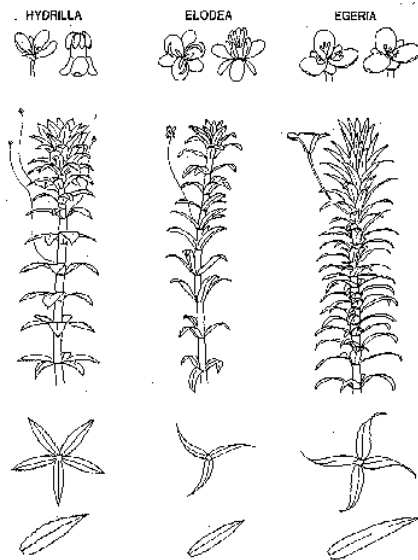
Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is listed as a federally noxious weed and causes severe ecological



and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone.

Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this

concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.



In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also

have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (<http://plants.ifas.ufl.edu/>). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Management Action Strategy

Any areas of Eurasian watermilfoil re-growth should be chemically treated in 2008. More re-growth is expected in 2008, as the first signs of any re-growth were seen in September of 2006, and EWM abundance increased in 2007. However, the exact acreage that will require treatment in 2008 cannot yet be determined. It is recommended that these areas be treated with Renovate or 2, 4-D. Renovate has shown the ability to provide 2 years of control in some situations, although it should not be expected. Maintenance of the Eurasian watermilfoil population should be the highest priority. Spot treatments should be limited to areas of Eurasian watermilfoil infestation to protect the native species that are re-colonizing the lake.

If Eurasian watermilfoil forms any dense beds in 2007, the association may also wish to contact District 1 fisheries personnel about restricting boat travel in these areas until it can be treated. This should reduce the potential for milfoil fragments to re-infest other areas of the lake.

Treatment of native plants along shorelines is not recommended so that natives can continue to increase in the lake.

Herbicide Treatment Specifications

If 2, 4-D is used for herbicide treatments, then a concentration of 1.76 parts per million should be used to ensure adequate control. If Renovate is used, then the concentration should be between 1.0 and 1.5 parts per million.

13.0 Project Budget

2008 Cost Estimates

***All cost figures are estimates only. All prices are subject to change pending 2008 chemical pricing.**

1. Chemically treat areas of Eurasian milfoil re-growth
 - A. Treat up to 30 acres for Eurasian milfoil with Renovate or 2, 4-D \$14,250
2. Conduct a spring visual survey for EWM and a late season Tier II vegetation survey
 - A. Aquatic Vegetation Surveys and Plan Update Up to \$4,000

14.0 Monitoring and Plan Update Procedures

A visual survey should take place in spring of 2008 to map EWM locations and develop a treatment strategy. Areas of EWM re-growth should be mapped with GPS. Mapping software can then be used to estimate acreages for treatment areas.

A late season Tier II aquatic vegetation survey should also be conducted in 2008 to evaluate treatment effectiveness and evaluate native and invasive plant populations. Data from this survey can be compared to past survey data to continue to show long term trends following whole lake Sonar treatments.

15.0 References

Blessing, Arlene. 2004. Fundamentals of Pesticide Use: Indiana Pesticide Applicator Core Training Manual. Purdue University. West Lafayette, Indiana 106 pp.

Cunningham, Willam P., and Saigo, Barwbara W. 2001. Environmental Science: a Global Concern. McGraw Hill Inc. Boston, Massachusetts 646.

Dow Agrosiences Invasive Species Management. 1998-2007. Dow Agrosiences LLC. <http://www.dowagro.com/ivm/invasive/prod/dma.htm>

Getsinger, Kurt Ph.D. 2005. Aquatic Plant Management: Best Management Practices in Support of Fish and Wildlife Habitat. The Aquatic Ecosystem Restoration Foundation. 78 pp.

IDNR. 2004. Procedure Manual for Surveying Aquatic Vegetation: Tier II Reconnaissance Surveys. IN Department of Natural Resources, Division of Soil Conservation.

IDNR 2004. Procedure manual for surveying Aquatic Vegetation: Tier I and Tier II, Indiana Department of Natural Resources, Indianapolis, Indiana.

Kalff, Jacob. 2002. Limnology: Inland Water Ecosystems. Prentice Hall. Upper Saddle River, New Jersey. 592 pp.

Kannenburg, James R., and Schmidt, James C. 1998. How to Identify and Control Water Weeds and Algae: 5th edition. Applied Biochemists. Milwaukee, Wisconsin. 128pp.

Lembi, Carole 1997. Aquatic Pest Control: Category 5. Department of Botany and Plant Pathology: Purdue University. West Lafayette, Indiana. 58pp.

Pearson, Jed. 2004. A Proposed Sampling Method to Assess Occurrence, Abundance and Distribution of Submersed Aquatic Plants in Indiana Lakes. IN Department of Natural Resources. Division of Fish & Wildlife. Indianapolis, Indiana 37 pp.

Pullman, Douglas G. 1998. The Lake Association Leaders Aquatic Vegetation Management Guidance Manual.

Renovate 3 Specimen Label. 2003. SePRO Corporation. www.sepro.com

Scribailo, Robin W. Ph.D. & Alix, Mitchell S. 2003. Final Report on the Weevil Release Study for Indiana Lakes. Department of Botany and Plant Pathology. Purdue University. West Lafayette, IN.

Smith, Robert Leo and Smith, Thomas M. 2001. Ecology and Field Biology. Addison Wesley Longman, Inc. San Francisco, California. 771 pp.

Stern, Kinsingly R. 2000. Introductory Plant Biology. McGraw Hill. Madison, Wisconsin. 557 pp.

Tyllia, J. 2000. Northeastern Indiana Fishing Map Guide. Superior, Wisconsin. 184 pp.

16.0 Appendices

16.1 Calculations

Fluridone Calculations:

The following paragraph is taken directly from the Sonar A.S. label. It outlines the specific procedures for calculating the amount of Fluridone needed to treat a body of water.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar A.S. to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:

Quarts of Sonar A.S. required per treated surface acre =
Average water depth of treatment site (feet)
x Desired ppb concentration of active ingredient
x 0.0027

For example, the quarts per acre of Sonar A.S. required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:

$5 \times 25 \times 0.0027 = 0.33$ quarts per treated surface acre

When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured x 32. For example, $0.33 \text{ quarts} \times 32 = 10.5$ fluid ounces.

Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

The following chart outlines rate calculations for DMA – 4 IVM Herbicide. It was taken directly from the DMA – 4 IVM specimen label on Dow AgroSciences website.

<http://www.dowagro.com/ivm/invasive/prod/dma.htm>

Submerged Aquatic Weeds: Including Eurasian Water Milfoil (*Myriophyllum spicatum*)

Treatment Site	Maximum Application Rate [†]	Specific Use Directions
Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	<p>Application Timing: For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas.</p> <p>Subsurface Application: Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift.</p> <p>Surface Application: Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre.</p> <p>Aerial Application: Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per surface acre. For Microfoil® drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre.</p> <p>Apply to attain a concentration of 2 to 4 ppm (see table below).</p>

[†]DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Amount to Apply to Attain a Concentration of 2 to 4 ppm			
Surface Area	Average Depth (ft)	2,4-D Acid Equivalent to Apply (lb/acre)	Amount of DMA 4 IVM to Apply (gal/acre)
1 acre	1	5.4 to 10.8	1.42 to 2.84
	2	10.8 to 21.6	2.84 to 5.68
	3	16.2 to 32.4	4.26 to 8.53
	4	21.6 to 43.2	5.68 to 11.37
	5	27.0 to 54.0	7.10 to 14.21

The following table outlines rate calculations for Renovate 3 herbicide based on desired PPM and average depth of treatment area. It is taken directly from the Renovate 3 specimen label on SePRO Corporation's website:

www.sepro.com

Concentration of Triclopyr Acid in Water (ppm ae)					
	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	3.3	3.6	4.6
3	2.1	2.9	4.1	5.4	6.8
4	2.7	3.6	5.4	7.2	9.1
5	3.4	4.5	6.8	9.0	11.3
6	4.1	5.4	8.1	10.9	13.6
7	4.8	6.3	9.5	12.7	15.8
8	5.5	7.2	10.9	14.5	18.1
9	6.1	8.1	12.2	16.3	20.4
10	6.8	9.0	13.6	18.1	22.6
15	10.2	13.6	20.4	27.2	33.9
20	13.6	18.1	27.2	36.2	45.3

16.2 Common Aquatic Plants of Indiana

(See 2004 Management Plan)

16.3 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 12: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
----- <i>waiting period, in days</i> -----							
Copper Chelate	0	0 ^a	0	0	0	0	0
Copper Sulfate	0	0 ^a	0	0	0	0	0
Diquat	1–3	0 ^a	0	1	1–3	1–3	5
Endothall (granular) ^b	7	0 ^a	3	0	7	7	7
Endothall (liquid) ^b	7–25	0 ^a	3	7–25	7–25 ^d	7–25	7–25
Endothall 191 (granular) ^c	7–25	0 ^a	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid) ^c	7–25	0 ^a	3	7–25	7–25	7–25	7–25
Fluridone	0 ^e	0 ^a	0	0	7–30	7–30	7–30
Glyphosate	0 ^e	0 ^a	0	0	0	0	0
2,4-D (granular)	*	0 ^a	0	*	*	*	*

^aAlthough this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

^bTrade name is Aquathol®.

^cTrade name is Hydrothol®.

^dMay be used for sprinkling bent grass immediately.

^eDo not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.4 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA)

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.5 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS

Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM. These changes become effective on July 1, 2002.**

Chapter 9. Regulation of Fishing

IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:

- (1) A privately owned lake, farm pond, or public or private drainage ditch.
- (2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:

(A) The area where vegetation is to be controlled does not exceed:

- (i) twenty-five (25) feet along the legally established, average, or normal shoreline;
- (ii) a water depth of six (6) feet; and

(iii) a total surface area of six hundred twenty-five (625) square feet.

(B) Control of vegetation does not occur in a public waterway of the state.

(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.

(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars (\$5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.

(d) This section does not do any of the following:

- (1) Act as a bar to a suit or cause of action by a person or governmental agency.
- (2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.

(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).

As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits

Authority: IC 14-22-2-6; IC 14-22-9-10

Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.

(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:

- (1) The common name of the plants to be controlled.
- (2) The acreage to be treated.
- (3) The maximum depth of the water where plants are to be treated.
- (4) The name and amount of the chemical to be used.

(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit

holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. (*Natural Resources Commission; 312*)

16.6 Species Distribution Maps

Figure 8: August 2007 Sago Pondweed Locations



Figure 9: August 2007 Slender Naiad Locations

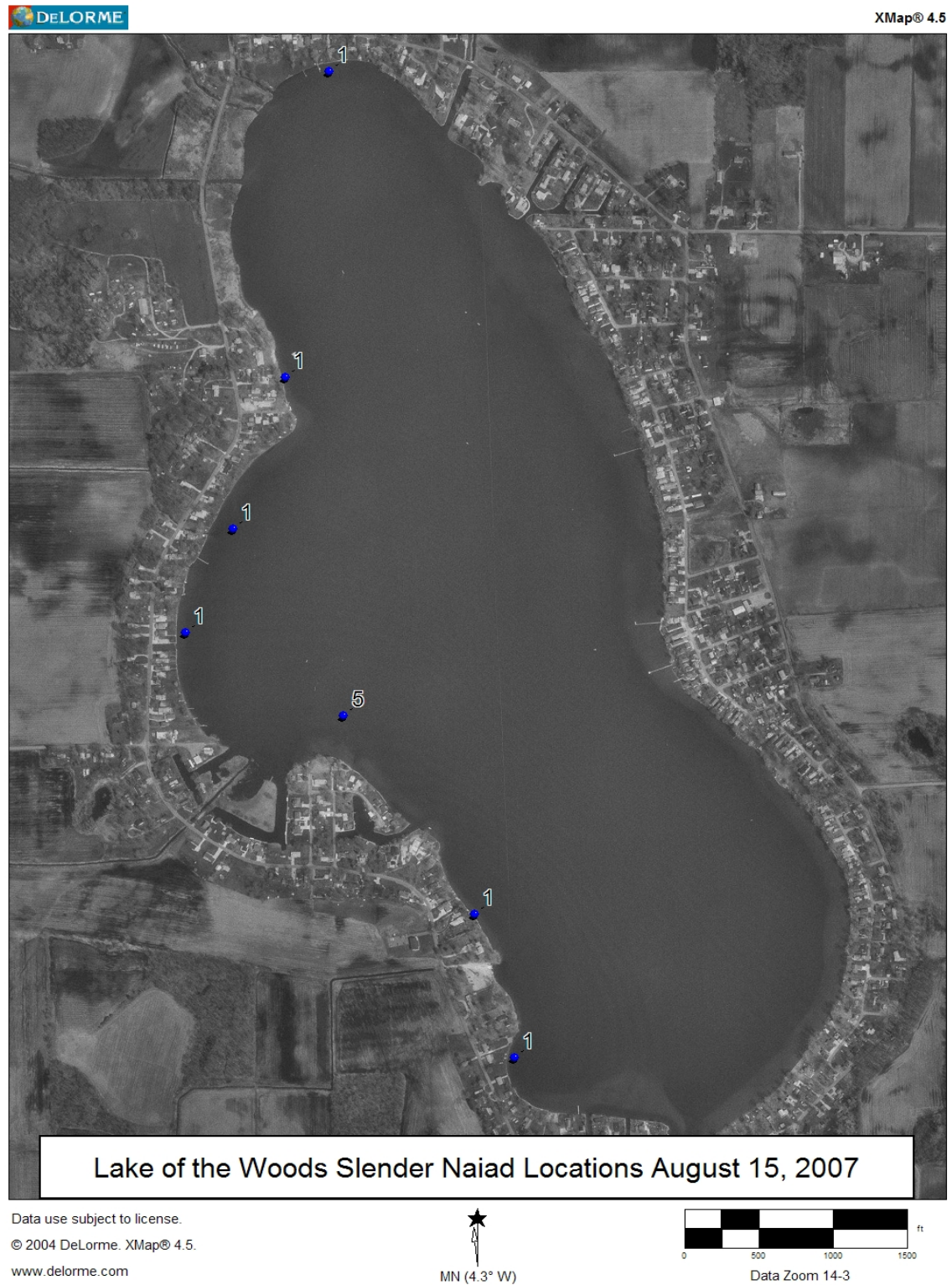


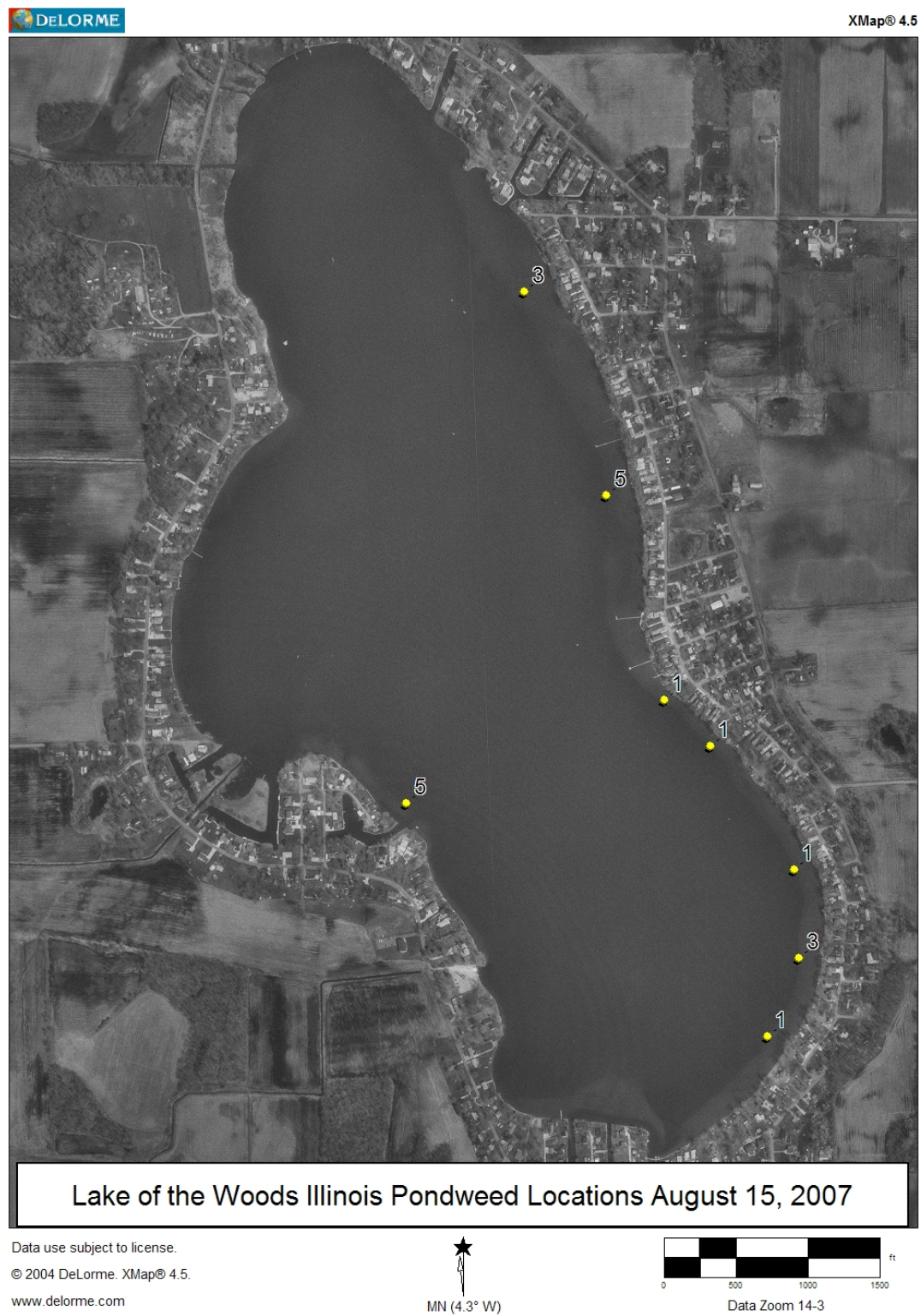
Figure 10: August 2007 Illinois Pondweed Locations

Figure 11: August 2007 Eurasian Watermilfoil Locations



Figure 12: August 2007 Elodea Locations

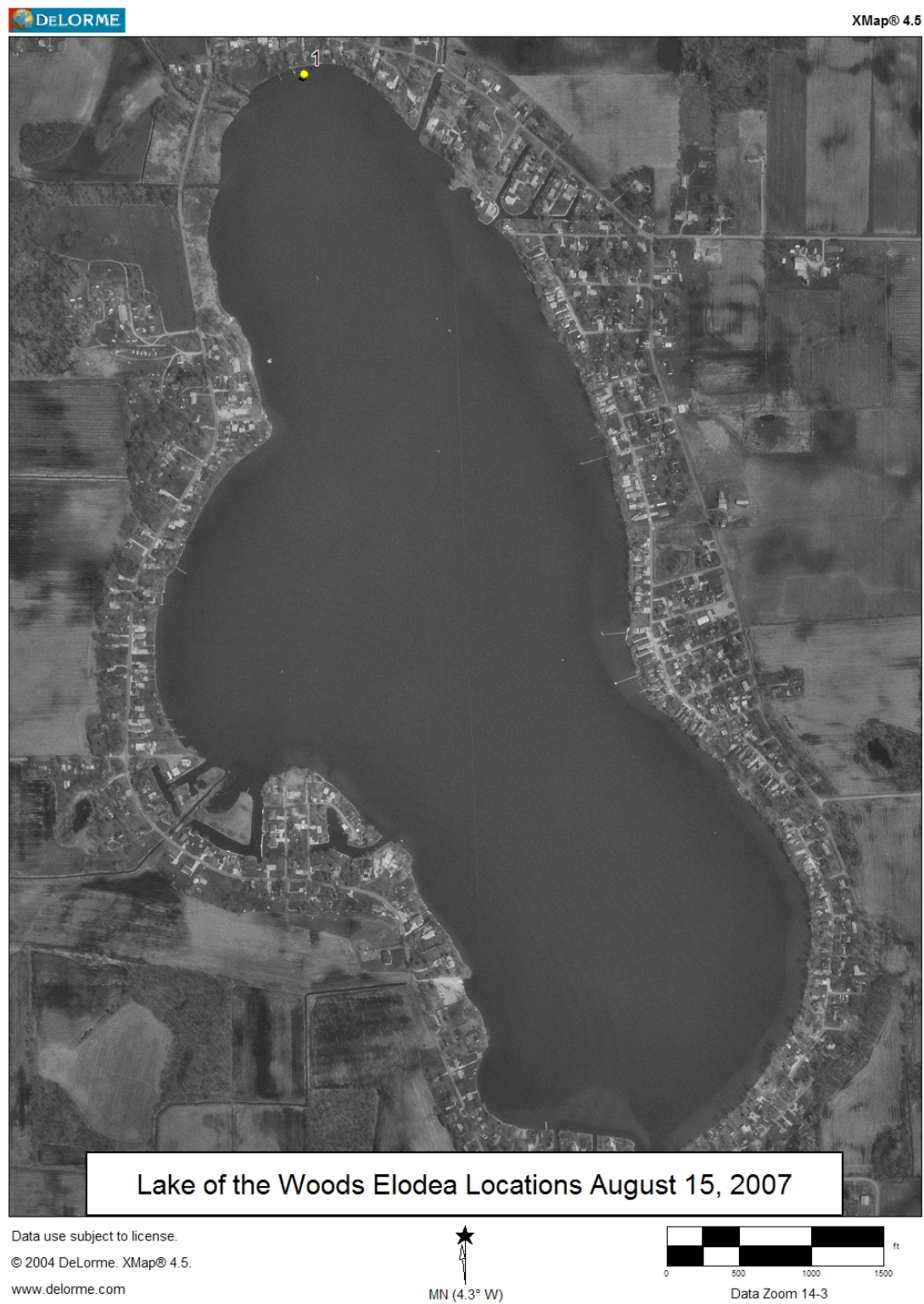


Figure 13: August 2007 Curly Leaf Pondweed Locations

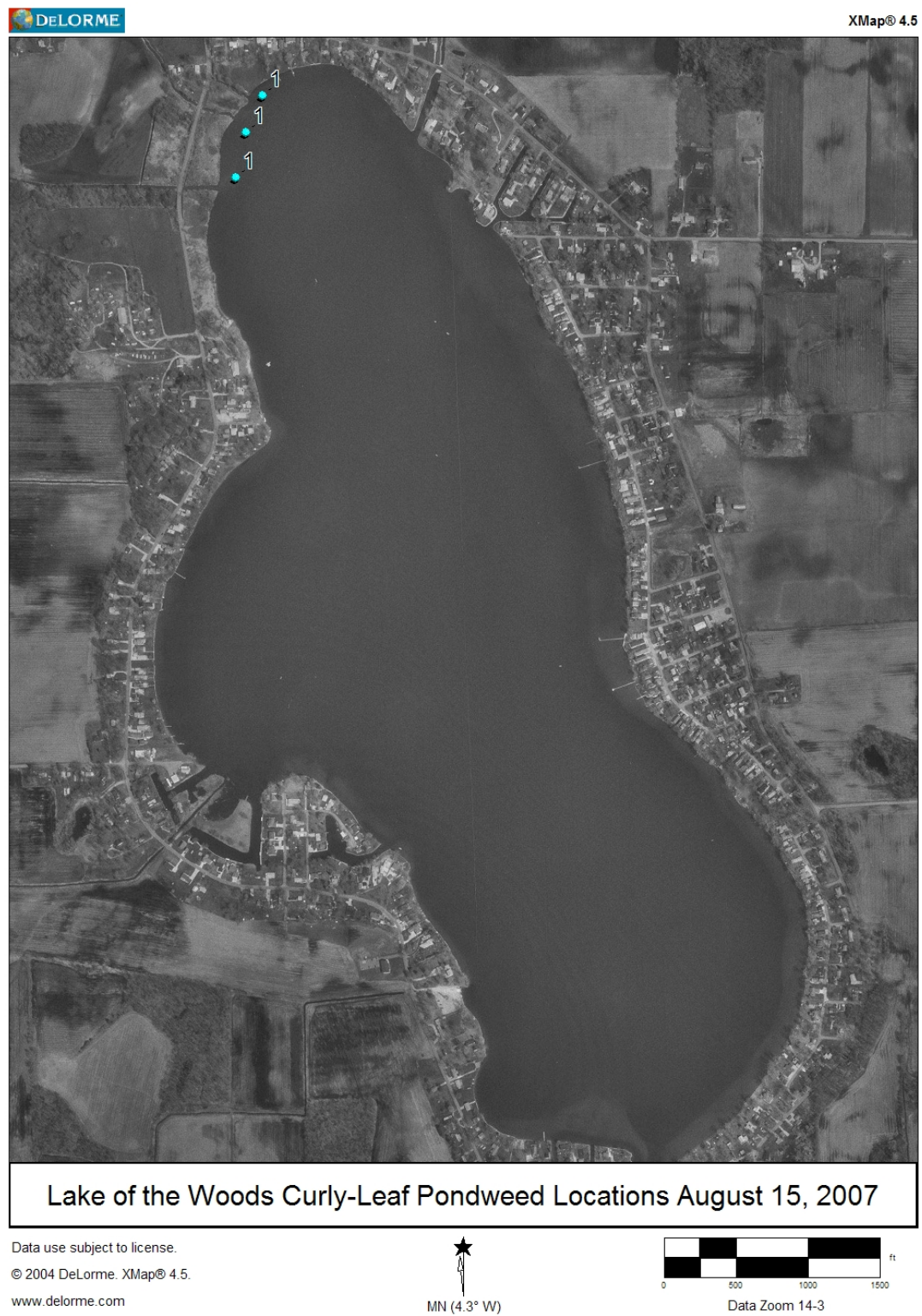


Figure 14: August 2007 Coontail Locations



Figure 15: August 2007 Chara Locations



16.7 Data Sheets

Aquatic Vegetation Random Sampling (Tier 2)			
<u>Waterbody Cover Sheet</u>			
Surveying Organization:	Aquatic Weed Control		
Contact Information:	574-533-2597		
Waterbody Name:	Lake of the Woods	Lake ID:	LOTW
County(s):	Marshall County	Date:	August 15, 2007
Habitat Stratum:	EL	Avg. Lake Depth (ft):	16 ft
		Lake Level:	Aug
GPS Metadata			
Crew Leader:	Dave Keister	Datum:	NAD83
		Zone:	16
		Accuracy:	30 ft
Recorder:	Dave Keister	Method:	WAAS Enabled GPS
Secchi Depth (ft):	2.4	Total # of Points Surveyed:	80
		Total # of Species:	8
Littoral Zone Size (acres):	95	Littoral Zone Max. Depth (ft):	9 ft
<input type="checkbox"/> Measured		<input type="checkbox"/> Measured	
<input checked="" type="checkbox"/> Estimated		<input type="checkbox"/> Estimate (historical Secchi)	
		<input checked="" type="checkbox"/> Estimated (current Secchi)	
		max plant depth	
Notable Conditions:	Natives much more abundant than in 2006 Eurasian watermilfoil found in only 2 locations		

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 1 of 3

WATERBODY NAME: Lake of the Woods					DATE: 8-15-07											
COUNTY: Marshall					SECCHI DEPTH (FT): 2.4 ft											
SITE ID: Lotw					MAX PLANT DEPTH (FT): 9 ft											
SURVEYING ORGANIZATION: Aquatic Weed Control					WEATHER: Overcast some Rain											
CREW LEADER: Dave Reister					COMMENTS (Include voucher codes - V1, V2...):											
RECORDER: Dave Reister					Water temp - 79.8											
CONTACT INFO: 574-533-2597					Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.											
Point #	R/T	Latitude	Longitude	Depth	Species Codes:										A/G Notes	
					SPUR	CHAD	NATP	POTII	ELD	CERDE	POTCR	MYRSE				
→ 12		GPS Points		3	-											
			2	3	-											
			3	2	3											
			4	4	-											P
			5	2	3											
			6	2	1											
			7	4	1											
			8	3	-											
			9	5	-											
			10	2	1											
			11	4	-											
			12	2	-											
			13	5	1											
			14	2	-											
			15	2	-											
			16	5	-											
			17	4	-											
			18	2	-											
			19	2	1											
			20	4	-											
			21	3	3											
			22	3	3											
			23	2	1											
			24	3	-											
			25	4	-											
			26	3	-											
			27	4	-											P
			28	5	-											P
			29	3	-											
			30	2	5											
			31	2	3											
			32	2	1											
			33	4	5											
Other plant species observed at lake:																

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 2 of 3

WATERBODY NAME: <u>Lake of The Woods</u>					DATE: <u>8-15-07</u>									
COUNTY: <u>Marshall County</u>					SECCHI DEPTH (FT): <u>2.4 ft</u>									
SITE ID: <u>10TW</u>					MAX PLANT DEPTH (FT): <u>9ft</u>									
SURVEYING ORGANIZATION: <u>Aquatic Weed Control</u>					WEATHER: <u>overcast, some rain</u>									
CREW LEADER: <u>Dave Keister</u>					COMMENTS (Include voucher codes - V1, V2...):									
RECORDER: <u>Dave Keister</u>					<u>Water Temp = 79.8</u>									
CONTACT INFO: <u>574-533-2597</u>					Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.									
Point #	R/T	Latitude	Longitude	Depth	Species Codes:							Notes		
					STP	CHL	NAS	POT	II	CE	FR	EM	ALG	
→	R	GPS Points	34	2	3									
			35	2	3									
			36	5	1									
			37	5	1									
			38	4	1									
			39	3	1			5						
			40	1	1									
			41	2	1				5					
			42	3	3									
			43	3	3									
			44	9	3									
			45	8	1									
			46	6	1									
			47	7	1									
			48	10	1									
			49	9	1									
			50	10	1									
			51	7	1									
			52	10	1									
			53	9	1									
			54	7	1									
			55	8	1									
			56	8	1									
			57	7	1									
			58	8	1									
			59	10	1									
			60	9	1									
			61	8	1									
			62	10	1									
			63	9	1									
			64	10	1									
			65	7	1									
			66	8	1									
Other plant species observed at lake:														

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 3 of 3

WATERBODY NAME: <u>Lake of the Woods</u>				DATE: <u>8-15-07</u>								
COUNTY: <u>Marshall County</u>				SECCHI DEPTH (FT): <u>2.4 ft</u>								
SITE ID: <u>LOTW</u>				MAX PLANT DEPTH (FT): <u>9 ft</u>								
SURVEYING ORGANIZATION: <u>Aquatic Weed Control</u>				WEATHER: <u>Overcast, some rain</u>								
CREW LEADER: <u>Dave Kester</u>				COMMENTS (Include voucher codes - V1, V2...):								
RECORDER: <u>Dave Kester</u>				<u>Water temp 74.8</u>								
CONTACT INFO: <u>574-533-2597</u>				Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.								
Point #	R/T	Latitude	Longitude	Depth	Species Codes:						X/6 Notes	
→ R		GPS Points	47	9	-							
			68	6	-							
			69	8	-							
			70	7	-							
			71	15	-							
			72	14	-							
			73	12	-							P
			74	11	-							
			75	14	-							
			76	11	-							
			77	13	-							
			78	15	-							
			79	15	-							
			80	15	-							
Depth	DO	Temp										
0	7.99	79.8										
1.5	7.94	80.3										
3	7.92	80.4										
4.5	7.90	80.4										
6	7.40	80.5										
7.5	6.87	80.3										
9	6.69	80.2										
10.5	6.43	80.1										
12	5.53	79.7										
12.5	0.14	77.3										
15	0.10	75.0										
16.5	0.09	73.8										
18	0.07	72.5										
19.5	0.06	70.5										
Other plant species observed at lake:												

Sample Site GPS Coordinates

Latitude	Longitude	Site
41.416935	-86.228809	1
41.415395	-86.228303	2
41.415275	-86.225817	3
41.414685	-86.22335	4
41.415866	-86.22153	5
41.417338	-86.220732	6
41.419017	-86.220846	7
41.420295	-86.222035	8
41.421359	-86.222965	9
41.422238	-86.224127	10
41.423553	-86.225509	11
41.424694	-86.22569	12
41.426108	-86.225595	13
41.427202	-86.225723	14
41.428203	-86.226447	15
41.428991	-86.227327	16
41.429976	-86.227682	17
41.430992	-86.228449	18
41.431901	-86.229363	19
41.432952	-86.230164	20
41.433733	-86.230767	21
41.434295	-86.231773	22
41.434473	-86.232836	23
41.434099	-86.23385	24
41.433395	-86.234268	25
41.432532	-86.23454	26
41.431728	-86.234697	27
41.430582	-86.234704	28
41.429743	-86.234484	29
41.428548	-86.233917	30
41.427449	-86.233392	31
41.426652	-86.23445	32
41.425623	-86.23521	33
41.424735	-86.235992	34
41.423616	-86.236354	35
41.422796	-86.235813	36
41.421781	-86.235315	37
41.42116	-86.233986	38
41.422014	-86.232508	39
41.421115	-86.232014	40
41.420272	-86.230666	41
41.419139	-86.230026	42
41.418155	-86.229289	43
41.416464	-86.228176	44
41.415281	-86.227058	45
41.416517	-86.225334	46
41.417217	-86.224204	47

41.417336	-86.222498	48
41.419745	-86.22147	49
41.421787	-86.223828	50
41.422916	-86.225212	51
41.424338	-86.226087	52
41.425764	-86.226381	53
41.427456	-86.226853	54
41.430417	-86.229601	55
41.432748	-86.231036	56
41.433232	-86.232582	57
41.432125	-86.233227	58
41.430261	-86.233909	59
41.428287	-86.233542	60
41.426395	-86.233618	61
41.424829	-86.234863	62
41.423811	-86.235225	63
41.423086	-86.234743	64
41.422543	-86.233677	65
41.421899	-86.232108	66
41.42066	-86.231317	67
41.419885	-86.229983	68
41.418643	-86.229596	69
41.417699	-86.228658	70
41.417134	-86.227745	71
41.416526	-86.22667	72
41.418076	-86.225367	73
41.422457	-86.224664	74
41.425484	-86.227144	75
41.429311	-86.229221	76
41.431501	-86.231183	77
41.429824	-86.232099	78
41.425578	-86.232878	79
41.423534	-86.232544	80

END

16.8 IDNR Aquatic Vegetation Control Permit

To be included in the final report.

